



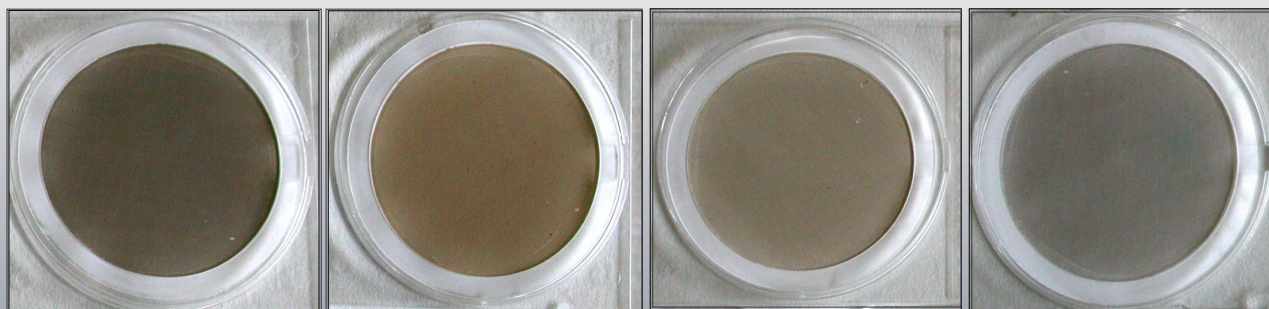
ISPRA

Istituto Superiore per la Protezione
e la Ricerca Ambientale



Sistema Nazionale
per la Protezione
dell'Ambiente

DUST CONTRIBUTION IN ITALY FROM EC-GUIDELINES APPLICATION



ALESSANDRO DI MENNO DI BUCCHIANICO

inDust

User Workshop on Dust products for Air Quality
11-12 Mar 2019 - Rome, Italy

Air quality legislation and identification of African dust episodes over Europe

EARLY EUROPEAN DIRECTIVES ON PARTICULATE MATTER

Until the year 1999, monitoring of PM levels was based on the determination of the levels of black smoke (BS) and total suspended particles (TSP): **European Directives 80/779/CEE** and **89/427/CEE** (In Italy an annual target value for PM₁₀ was introduced in the **25/11/1994 Ministerial Decree**).

COUNCIL DIRECTIVE 1999/30/EC

Article 2 (Definitions) 'natural events' shall mean volcanic eruptions, seismic activities, geothermal activities, wild-land fires, highwind events or the atmospheric resuspension or **transport of natural particles from dry regions**.

Article 5 (Particulate matter) Where the limit values for PM₁₀ are exceeded owing to concentrations of PM₁₀ in ambient air due to natural events [...] Member States shall inform the Commission [...] providing the necessary justification to demonstrate that such exceedances are due to natural events. Member States shall be obliged to implement action plans [...] only where the limit values [...] are exceeded owing to causes other than natural events.

COUNCIL DIRECTIVE 2008/50/EC

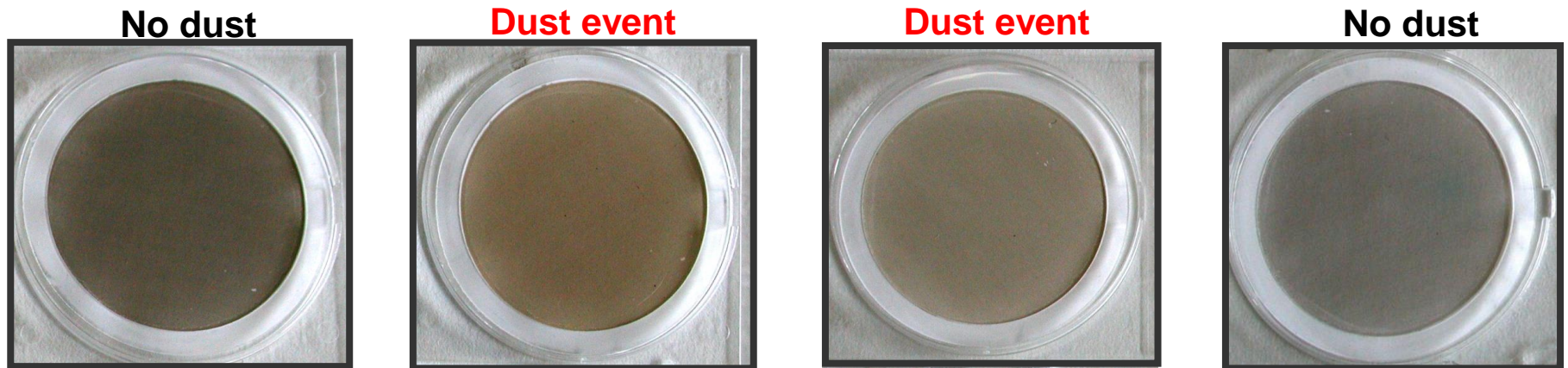
(15) **Contributions from natural sources can be assessed but cannot be controlled**. Where natural contributions to pollutants in ambient air can be determined with sufficient certainty, and where exceedances are due in whole or in part to these natural contributions, these may [...] be subtracted when assessing compliance with air quality limit values.

Article 2 (Definitions) 'contributions from natural sources' shall mean emissions of pollutants not caused directly or indirectly by human activities, including **natural events** such as volcanic eruptions[...] or **transport of natural particles from dry regions**.

EC SEC(2011) 208 (18/2/2011) GUIDELINES for demonstration and subtraction of exceedances attributable to natural sources under the Directive 2008/50/EC on ambient air quality and cleaner air for Europe

EC method for demonstration and subtraction of exceedances attributable to natural sources

- 1 - Identifying Saharan dust outbreak episodes;
- 2 - selection of regional background reference stations;
- 3 - quantifying Saharan dust contribution in reference stations and daily PM_{10} concentration in stations belonging to regional zones in exceedance;
- 4 - subtraction of exceedances attributable to natural sources under the Directive 2008/50/EC.



PM_{10} TEFLON FILTERS

1 a - Identifying Saharan dust outbreak episodes

Identification Process

African episode
identified by
BSC- DREAM8b v2.0

African episode
identified by
HYSPLIT

African episode
linked to AQ
monitoring station

Repeated for
each station / day

Process partially
automated by GIS tool

Subjective
interpretation of
maps avoided

HYSPLIT

Back traj. (one level at least)
intersects Saharan areas

BSC DREAM8b v 2.0

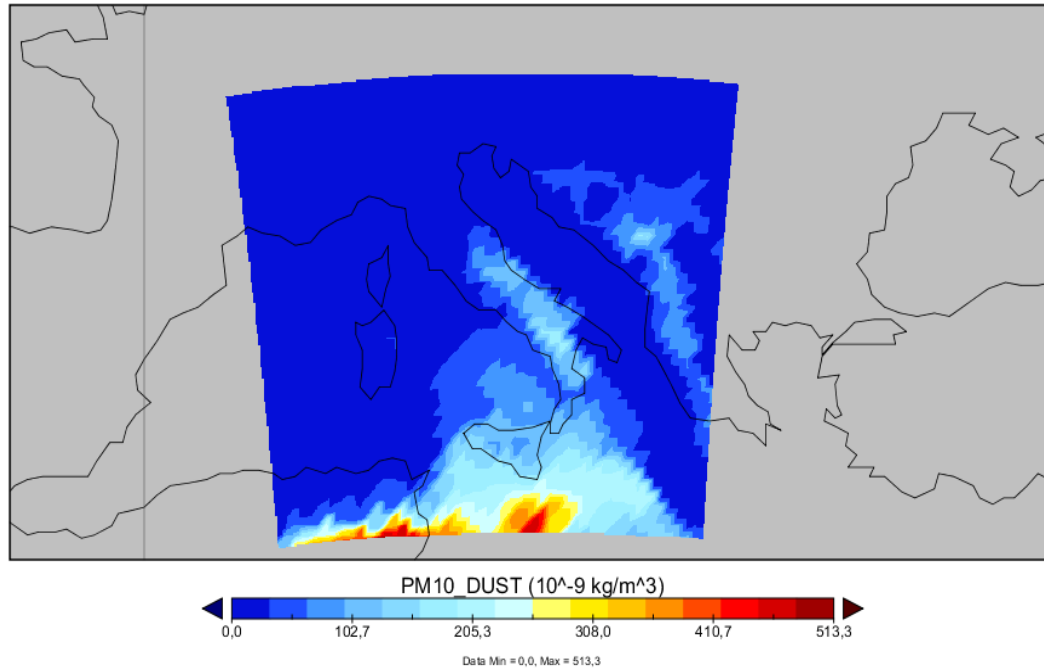
Nearest neighbour approach
between grid cells and monit.
stations

Hysplit pc version and BSC
DREAM model output used
(not on-line maps)

- **Ongoing development:** fully automated process by GIS tool and Python scripts
- **Future development:** fully automated process with possibility of import data (netcdf) from other models

1 b - Identifying Saharan dust outbreak episodes

PM10_DUST

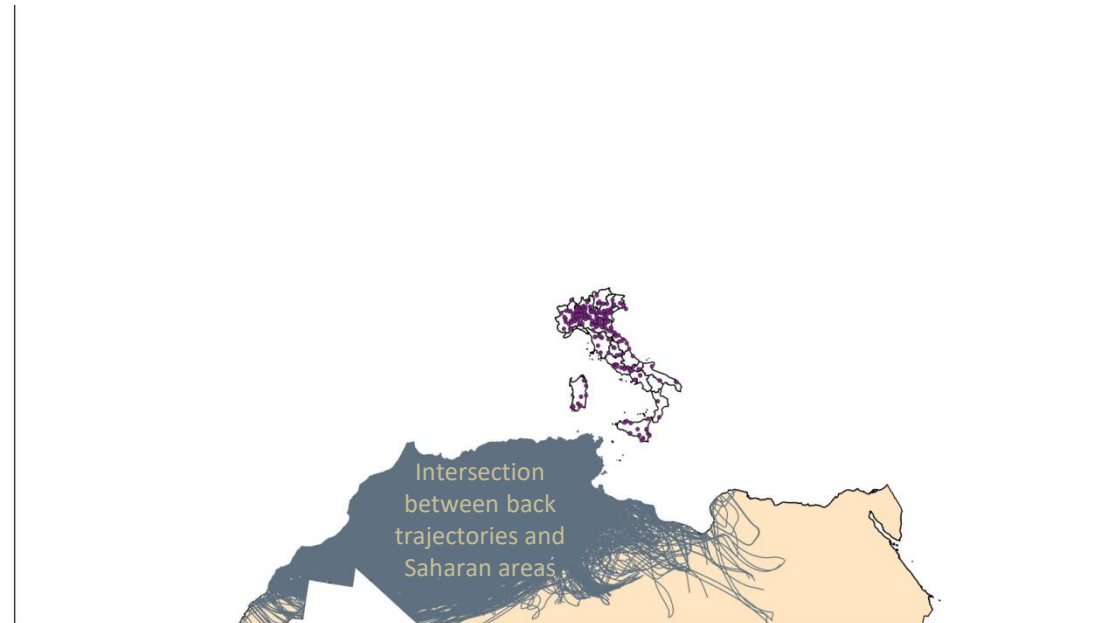


BSC-DREAM model

Re-analysed dust concentration
data at surface level on a
30x30 km² grid

Hysplit tool

Back trajectories at three levels:
750 m, 1500 m, 2500 m



2 a - Selection of regional background reference stations

Six criteria that allowed a univocal selection of a reference station for a given area were applied:

1. the maximum overlap between days of event identified in the Candidate Reference Station (CRS) and the urban station (US) that exceeds the daily EC limit value;
2. the maximum correlation between the data series from the CRS and the considered US;
3. the minimum distance between CRS station and US;
4. the minimum difference in elevation between CRS and US;
5. the maximum data coverage;
6. the minimum midspread (interquartile range).

REMARK: A different choice of the reference station will significantly change the final evaluation of the Saharan contribution to the number of days that exceeds the EC limit value and if the spatial representativeness of the reference station is low, the real number of episodes is over or underestimated.

2 b - Selection of regional background reference stations

Representativeness Index (*RI*) of the reference station

Example of application to the case of Lazio, 2012

Station in exceedance	FROSINONE SCALO					
CRS (Candidate Reference Stations)	ACQUAPENDENTE (RB)	LEONESSA (RB)	CASTEL DI GUIDO (RB)	FONTECHIARI (RB)	TENUTA DEL CAVALIERE (SB)	VILLA ADA (UB)
Data Cov.	0,98	0,99	0,95	1,00	1,00	0,97
Conf. events	0,88	0,82	0,94	1,00	0,95	0,93
Elevation	0,39	0,13	1,00	0,44	0,88	0,90
R (PCC)	0,72	0,40	0,54	1,00	0,88	1,02
Distance	0,17	0,27	0,31	1,00	0,45	0,38
Midspread	0,97	1,00	0,67	0,94	0,57	0,80
<i>RI</i>	4,10	3,61	4,41	5,38	4,73	5,00

Best reference
station

Station in exceedance	C. FRANCIA (Rome)					
CRS (Candidate Reference Stations)	ACQUAPENDENTE (RB)	LEONESSA (RB)	CASTEL DI GUIDO (RB)	FONTECHIARI (RB)	TENUTA DEL CAVALIERE (SB)	VILLA ADA (UB)
Data Cov.	0,98	0,99	0,95	1,00	1,00	0,97
Conf. events	0,99	0,93	1,00	0,88	1,03	1,06
Elevation	0,05	0,02	1,00	0,05	3,60	2,57
R (PCC)	0,86	0,76	1,00	0,99	1,07	1,18
Distance	0,18	0,23	1,00	0,19	1,16	5,23
Midspread	0,97	1,00	0,67	0,94	0,57	0,80
<i>RI</i>	4,03	3,93	5,61	4,05	8,44	11,81

Best rural station

(selected as reference in
accordance with EC GLs)

Best reference
station

2 c - Selection of regional background reference stations

Potential disadvantages of selecting reference station without objective criteria

			Italy 2012			
Region	Station in exceedance	Type	% of confirmed events at candidate reference stations		Selected reference station	Spread
			min	Max		
Piedmont	D'Annunzio (AL)	UT	66%	97%	Vinchio - San Michele (RB)	31%
(Northwest Italy)	Distance from CRS (km)		Baceno - Alpe Devero (RB)	Dernice - Costa (RB)		
Tuscany	FERRUCCI (PO)	UT	74%	98%	PT-MONTALE (RB)	24%
(Central Italy)	Distance from CRS (km)		AR-CASA STABBI (RB)	PT-MONTALE (RB)		
Sicily	PORTO EMPEDOCLE (AG)	UI	78%	100%	Marina di Ragusa (SB)	22%
(Southern and insular Italy)	Distance from CRS (km)		Termica Milazzo (SB)	AG VALLE DEI TEMPLI (SB)		

REMARK: Including suburban and, better, urban background station could improve the spatial representativeness, increasing the percentage of confirmed events up to 100%

2 d - Selection of regional background reference stations

Number of exceedances and yearly average after subtraction of Saharan contribution using different reference stations (50th percentile)

2012				
C. FRANCIA (Rome)	Exc 24hLV	Y avrg	Identified events during days of exceedances of 24hLV	N. of removed exceedances
	57	36 µg/m ³		
Candidate Reference Stations	After subtraction			
ACQUAPENDENTE (RB)	49	35 µg/m ³	8	8
LEONESSA (RB)	50	35 µg/m ³	9	7
Best rural station (selected as reference in accordance with EC GLs)	CASTEL DI GUIDO (RB)	48	35 µg/m ³	9
	FONTECHIARI (RB)	50	35 µg/m ³	8
	TENUTA DEL CAVALIERE (SB)	49	35 µg/m ³	8
Best reference station	VILLA ADA (UB)	49	35 µg/m ³	8

REMARK: The extra day subtracted on the basis of Castel di Guido RS was linked to a natural event not confirmed in Rome

3 a - Quantifying Saharan dust contribution in reference stations and PM10 concentration w/o SD events

Station with PM₁₀
exceedances

Reference
station

DAY	Rome - C.SO_FRANCIA	C.SO FRANCIA Dream_episodes	Rome - CASTEL_DI_GUIDO	CASTEL DI GUIDO Dream_episodes	Quantification of saharan dust contribution (30_Prc)	Quantification of saharan dust contribution (40_Prc)	Quantification of saharan dust contribution (50_Prc)	Quantification of saharan dust contribution (Avg)	C. FRANCIA PM10 Quantification30	C. FRANCIA PM10 Quantification40	C. FRANCIA PM10 Quantification50	C. FRANCIA PM10 QuantificationA
03/03/2012	57		35		0,0	0,0	0,0	0,0	57,0	57,0	57,0	57,0
04/03/2012	53		39		0,0	0,0	0,0	0,0	53,0	53,0	53,0	53,0
05/03/2012	44		30		0,0	0,0	0,0	0,0	44,0	44,0	44,0	44,0
06/03/2012	38		20		0,0	0,0	0,0	0,0	38,0	38,0	38,0	38,0
07/03/2012	55		21		0,0	0,0	0,0	0,0	55,0	55,0	55,0	55,0
08/03/2012			34		0,0	0,0	0,0	0,0				
09/03/2012			25		0,0	0,0	0,0	0,0				
10/03/2012	21	1,2	20	0,9	0,0	0,0	0,0	0,0	21,0	21,0	21,0	21,0
11/03/2012	25		16		0,0	0,0	0,0	0,0	25,0	25,0	25,0	25,0
12/03/2012	30		17		0,0	0,0	0,0	0,0	30,0	30,0	30,0	30,0
13/03/2012	29		17		0,0	0,0	0,0	0,0	29,0	29,0	29,0	29,0
14/03/2012	37		21		0,0	0,0	0,0	0,0	37,0	37,0	37,0	37,0
15/03/2012	56		38		0,0	0,0	0,0	0,0	56,0	56,0	56,0	56,0
16/03/2012	60		46		0,0	0,0	0,0	0,0	60,0	60,0	60,0	60,0
17/03/2012	49		35		0,0	0,0	0,0	0,0	49,0	49,0	49,0	49,0
18/03/2012	31	4,5	22	1,2	0,0	0,0	0,0	0,0	31,0	31,0	31,0	31,0
19/03/2012	43	11,1	28	4,9	3,7	1,8	0,0	0,0	39,3	41,2	48,0	43,0
20/03/2012	48	12,4	34	7,4	10,0	9,0	4,0	5,9	38,0	39,0	44,0	42,1
21/03/2012	54	8,4	46	8,5	22,9	21,0	16,5	18,0	31,1	33,0	37,5	36,0
22/03/2012	64		53	2,6	28,6	27,4	22,0	24,6	35,4	36,6	42,0	39,4
23/03/2012	61	3,9	53	3,4	28,0	25,6	22,0	24,2	33,0	35,4	39,0	36,8
24/03/2012	50	5,4	47	6,3	22,9	22,0	17,5	19,3	27,1	28,0	32,5	30,7
25/03/2012	42		31		0,0	0,0	0,0	0,0	42,0	42,0	42,0	42,0
26/03/2012	46		32		0,0	0,0	0,0	0,0	46,0	46,0	46,0	46,0
27/03/2012	36		24		0,0	0,0	0,0	0,0	36,0	36,0	36,0	36,0
28/03/2012	48		32		0,0	0,0	0,0	0,0	48,0	48,0	48,0	48,0
29/03/2012	51		34		0,0	0,0	0,0	0,0	51,0	51,0	51,0	51,0
30/03/2012	48		33		0,0	0,0	0,0	0,0	48,0	48,0	48,0	48,0
31/03/2012	44		31		0,0	0,0	0,0	0,0	44,0	44,0	44,0	44,0
01/04/2012	36		28		0,0	0,0	0,0	0,0	36,0	36,0	36,0	36,0
02/04/2012	37		25		0,0	0,0	0,0	0,0	37,0	37,0	37,0	37,0
03/04/2012	37	2,1	27	1	12,6	10,4	7,5	5,9	24,4	26,6	29,5	31,2
04/04/2012	47	29,4	36	7	23,0	20,0	17,0	15,3	24,0	27,0	30,0	31,7
05/04/2012	61	41	41	20,5	28,0	25,6	23,0	20,8	33,0	35,4	38,0	40,2
06/04/2012	33	15	25	21,2	12,0	10,0	8,0	5,0	21,0	23,0	25,0	28,0
07/04/2012	32	3,3	18	4	5,0	2,8	1,5	0,0	27,0	29,2	30,5	32,0
08/04/2012	16		13		0,0	0,0	0,0	0,0	16,0	16,0	16,0	16,0

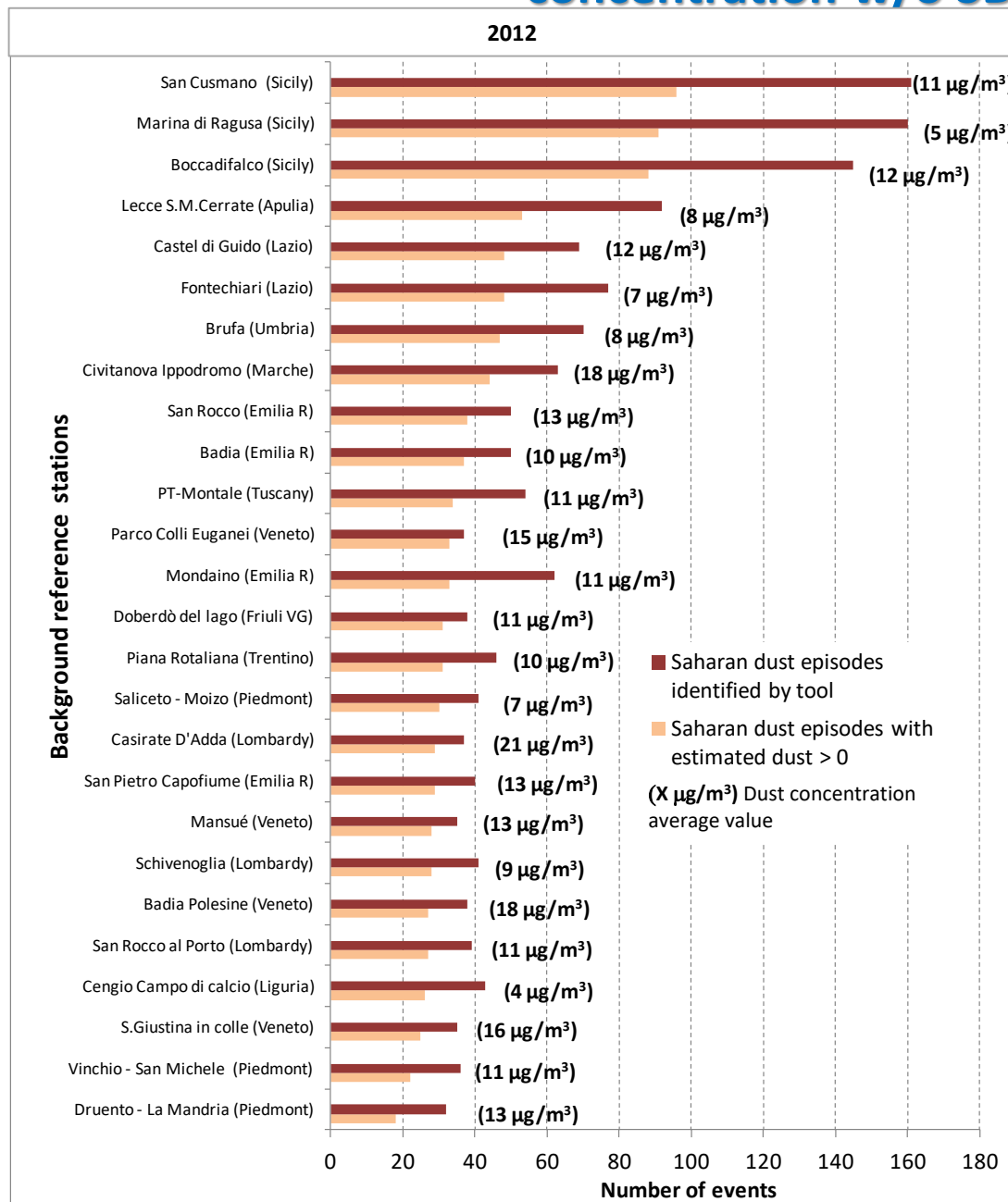
3 a - Quantifying Saharan dust contribution in reference stations and PM10 concentration w/o SD events

Station with PM₁₀
exceedances

Reference
station

DAY	Rome - C.SO_FRANCIA	C.SO FRANCIA Dream_episodes	Rome - CASTEL DI GUIDO	CASTEL DI GUIDO Dream_episodes	Quantification of saharan dust contribution (30_Prc)	Quantification of saharan dust contribution (40_Prc)	Quantification of saharan dust contribution (50_Prc)	Quantification of saharan dust contribution (Avg)	C. FRANCIA PM10 Quantification30	C. FRANCIA PM10 Quantification40	C. FRANCIA PM10 Quantification50	C. FRANCIA PM10 QuantificationA
03/03/2012	57		35		0,0	0,0	0,0	0,0	57,0	57,0	57,0	57,0
04/03/2012	53		39		0,0	0,0	0,0	0,0	53,0	53,0	53,0	53,0
05/03/2012	44		30		0,0	0,0	0,0	0,0	44,0	44,0	44,0	44,0
06/03/2012	38		20		0,0	0,0	0,0	0,0	38,0	38,0	38,0	38,0
07/03/2012	55		21		0,0	0,0	0,0	0,0	55,0	55,0	55,0	55,0
08/03/2012			34		0,0	0,0	0,0	0,0				
09/03/2012			25		0,0	0,0	0,0	0,0				
10/03/2012	21	1,2	20	0,9	0,0	0,0	0,0	0,0	21,0	21,0	21,0	21,0
11/03/2012	25		16		0,0	0,0	0,0	0,0	25,0	25,0	25,0	25,0
12/03/2012	30		17		0,0	0,0	0,0	0,0	30,0	30,0	30,0	30,0
13/03/2012	29		17		0,0	0,0	0,0	0,0	29,0	29,0	29,0	29,0
17/03/2012			49		0,0	0,0	0,0	0,0	37,0		49,0	37,0
18/03/2012			31		0,0	0,0	0,0	0,0	56,0		31,0	60,0
19/03/2012			43	1,2	0,0	0,0	0,0	0,0	60,0		43,0	49,0
20/03/2012			48	4,9	3,7	4,0	4,0	4,0	31,2	42,1	44,0	43,0
21/03/2012			54	8,5	22,9	16,5	16,5	16,5	39,0	36,0	37,5	39,4
22/03/2012			64	3,4	28,0	22,0	22,0	22,0	35,0	30,7	42,0	36,8
25/03/2012	42		31		0,0	0,0	0,0	0,0	27,6	42,0	42,0	42,0
26/03/2012	46		32		0,0	0,0	0,0	0,0	42,0	46,0	46,0	46,0
27/03/2012	36		24		0,0	0,0	0,0	0,0	46,0	36,0	36,0	36,0
28/03/2012	48		32		0,0	0,0	0,0	0,0	36,0	48,0	48,0	48,0
29/03/2012	51		34		0,0	0,0	0,0	0,0	48,0	51,0	51,0	51,0
30/03/2012	48		33		0,0	0,0	0,0	0,0	48,0	48,0	48,0	48,0
31/03/2012	44		31		0,0	0,0	0,0	0,0	48,0	44,0	44,0	44,0
01/04/2012	36		28		0,0	0,0	0,0	0,0	44,0	36,0	36,0	36,0
02/04/2012	37		25		0,0	0,0	0,0	0,0	36,0	37,0	37,0	37,0
03/04/2012	37	2,1	27	1	12,6	10,4	7,5	5,9	37,0	24,4	29,5	31,2
04/04/2012	47	29,4	36	7	23,0	20,0	17,0	15,3	24,0	27,0	30,0	31,7
05/04/2012	61	41	41	20,5	28,0	25,6	23,0	20,8	33,0	35,4	38,0	40,2
06/04/2012	33	15	25	21,2	12,0	10,0	8,0	5,0	33,0	23,0	25,0	28,0
07/04/2012	32	3,3	18	4	5,0	2,8	1,5	0,0	27,0	29,2	30,5	32,0
08/04/2012	16		13		0,0	0,0	0,0	0,0	16,0	16,0	16,0	16,0

3 b - Quantifying Saharan dust contribution in reference stations and PM10 concentration w/o SD events

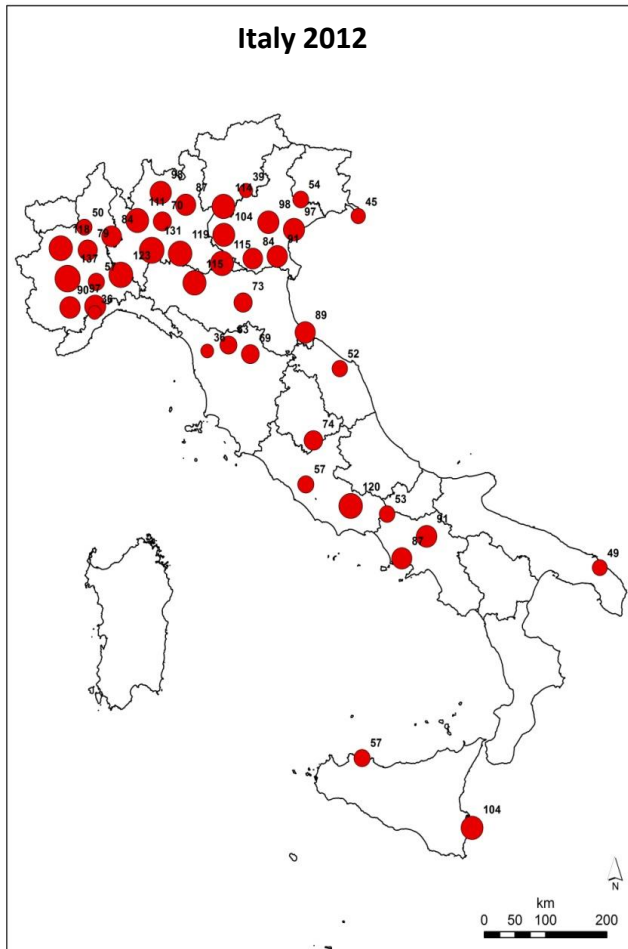


Quantification used as a 3rd step of identification

% of episodes with e.dust greater than 0	
San Cusmano (Sicily)	60%
Marina di Ragusa (Sicily)	57%
Boccadifalco (Sicily)	61%
Lecce S.M.Cerrate (Apulia)	58%
Fontechiari (Lazio)	62%
Castel di Guido (Lazio)	70%
Brufa (Umbria)	67%
Civitanova Ippodromo (Marche)	70%
San Rocco (Emilia R)	76%
Badia (Emilia R)	74%
PT-Montale (Tuscany)	63%
Mondaino (Emilia R)	53%
Parco Colli Euganei (Veneto)	89%
Piana Rotaliana (Trentino)	67%
Doberdò del lago (Friuli VG)	82%
Saliceto - Moizo (Piedmont)	73%
San Pietro Capofiume (Emilia R)	73%
Casirate D'Adda (Lombardy)	78%
Schivenoglia (Lombardy)	68%
Mansué (Veneto)	80%
San Rocco al Porto (Lombardy)	69%
Badia Polesine (Veneto)	71%
Cengio Campo di calcio (Liguria)	60%
S.Giustina in colle (Veneto)	71%
Vinchio - San Michele (Piedmont)	61%
Druento - La Mandria (Piedmont)	56%

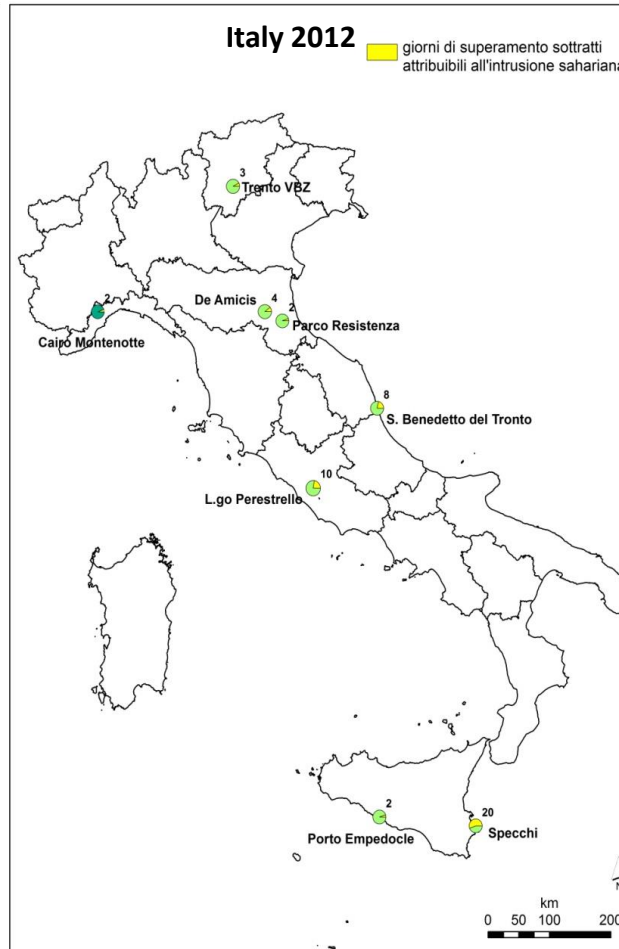
4 a - Subtraction of exceedances attributable to natural sources under the Directive 2008/50/EC

Italy 2012



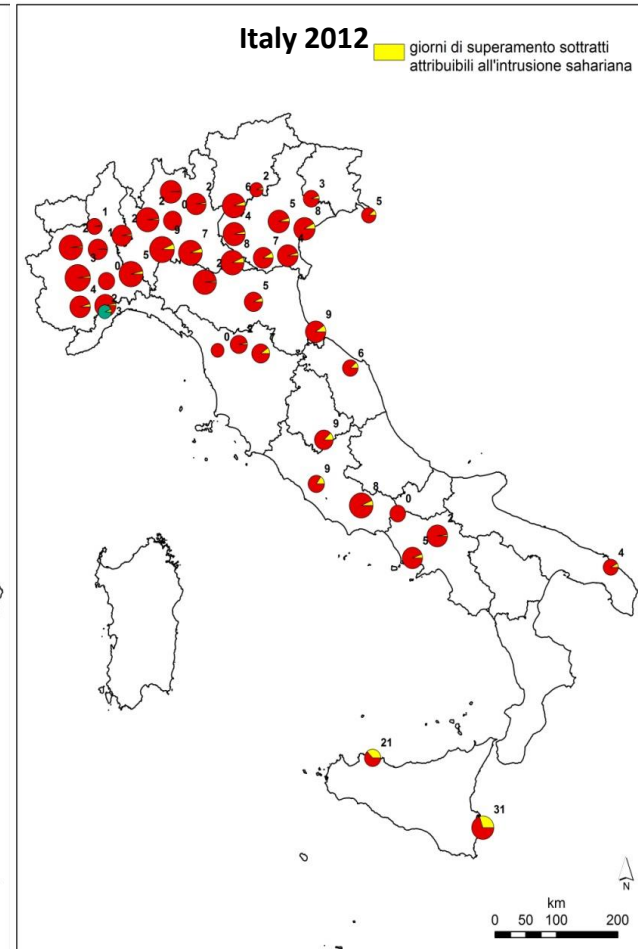
Italy 2012

giorni di superamento sottratti
attribuibili all'intrusione sahariana



Italy 2012

giorni di superamento sottratti
attribuibili all'intrusione sahariana



42 zones in exceedance of PM₁₀ DLV

8 stations not considered in exceedance

1 zone not considered in exceedance

Reliability and limitations of the EC guidelines

Type of station:

T: traffic;

B: background;

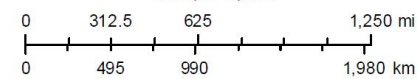
I: industrial



March 19, 2015

AirBase reporting stations

1:36,978,595



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
SES@EEA

Reliability and limitations of the EC guidelines

Rural background stations

SPAIN



- Background stations from air quality monitoring networks
- EMEP stations with real time measurements
- EMEP stations with gravimetric measurements

Background stations network used for detection of African episodes.

ITALY



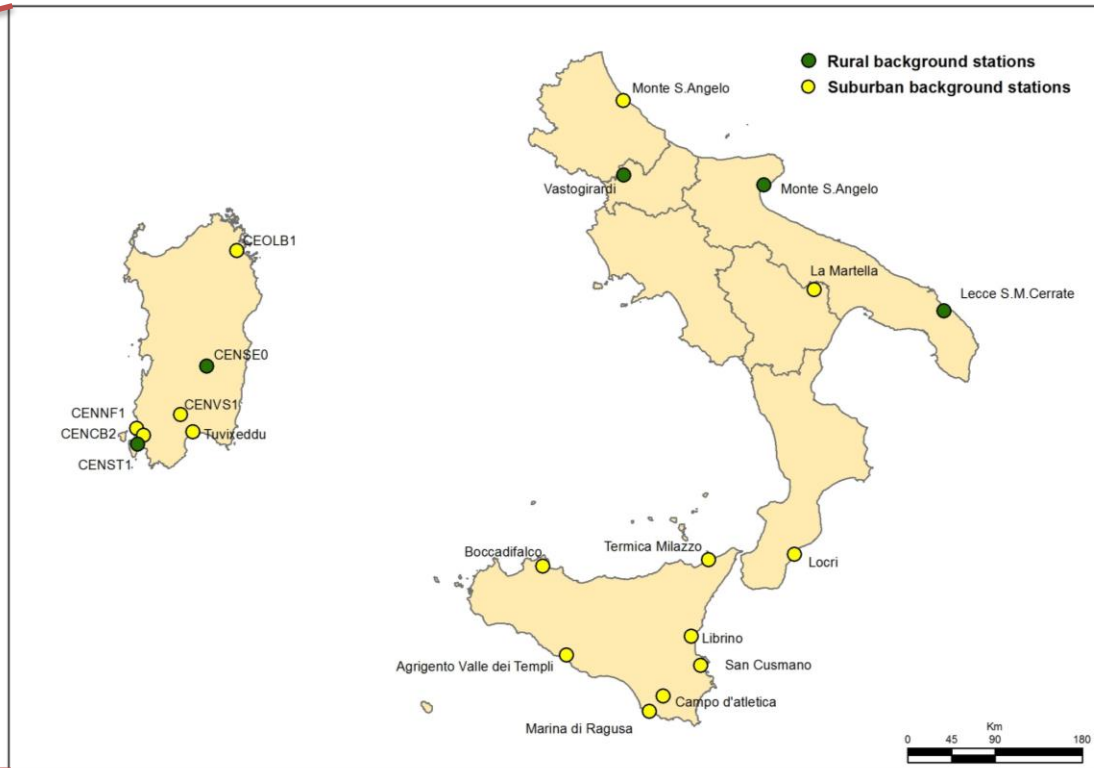
Differences in Italian regional AQ networks

Rural Background stations in Italy



- Rural background stations
- Suburban background stations

Rural plus Suburban Background stations in Southern and insular Italy



Reliability and limitations of the EC guidelines

Region	Exceedances attributable to S.Dust (30th P)*	Exceedances attributable to S.Dust (40th P)*	Exceedances attributable to S.Dust (50th P)*	Average concentration attributable to S.Dust (30th P)**	Average concentration attributable to S.Dust (40th P)**	Average concentration attributable to S.Dust (50th P)**	
Piedmont	3	2	2	1	1	1	[µg/m³]
Aosta Valley	-	-	-	-	-	-	-
Lombardy	4	4	4	2	1	1	[µg/m³]
Liguria	2	2	2	-	-	-	-
Alto Adige	-	-	-	-	-	-	-
Trentino	3	3	3	-	-	-	-
Veneto	6	5	5	1	1	1	[µg/m³]
Friuli Venezia Giulia	4	4	4	-	-	-	-
Emilia Romagna	6	5	5	2	1	1	[µg/m³]
Tuscany	2	2	2	-	-	-	-
Umbria	11	10	9	-	-	-	-
The Marches	7	7	7	-	-	-	-
Lazio	7	6	6	1	1	1	[µg/m³]
Abruzzo	-	-	-	-	-	-	-
Molise	1	0	0	-	-	-	-
Campania	3	2	2	1	1	1	[µg/m³]
Apulia	4	4	4	-	-	-	-
Basilicata	-	-	-	-	-	-	-
Calabria	-	-	-	-	-	-	-
Sicily	18	17	16	4	3	3	[µg/m³]
Sardinia	-	-	-	-	-	-	-
Average	5,0	4,6	4,3	1,5	1,4	1,2	[µg/m³]

*: Only for stations in exceedence of 24h PM₁₀ EC limit value

** : Only for stations in exceedence of annual PM₁₀ EC limit value

Importance of the choice of percentile value:

$$N_{\text{excd}} (\text{Quantification}_{30\text{Prctl}}) < 35 \wedge N_{\text{excd}} (\text{Quantification}_{50\text{Prctl}}) > 35 \Leftrightarrow$$

$$\text{Quantification}_{30\text{prctl}} \geq X$$

and

$$\text{Quantification}_{50\text{prctl}} < X$$

where

$$C_{\text{PM10}} > 50 = 50 + X [\mu\text{g}/\text{m}^3]$$

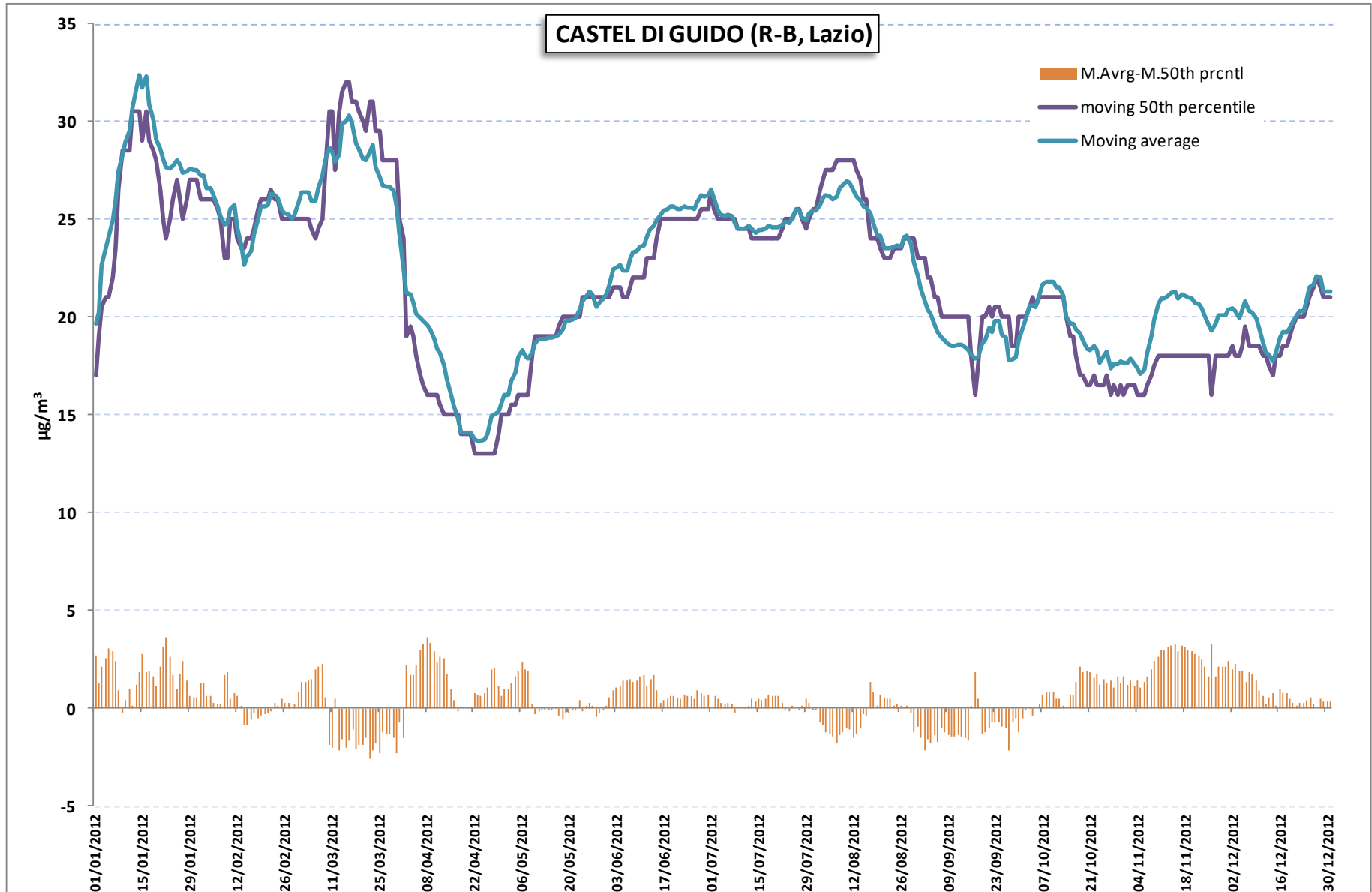
$$C_{\text{PM10}} - \text{Quantification}_{50\text{prctl}} > 50 [\mu\text{g}/\text{m}^3]$$

$$C_{\text{PM10}} - \text{Quantification}_{50\text{prctl}} - (\text{Qntf}_{30\text{prctl}} - \text{Qntf}_{50\text{prctl}}) \leq 50 [\mu\text{g}/\text{m}^3]$$

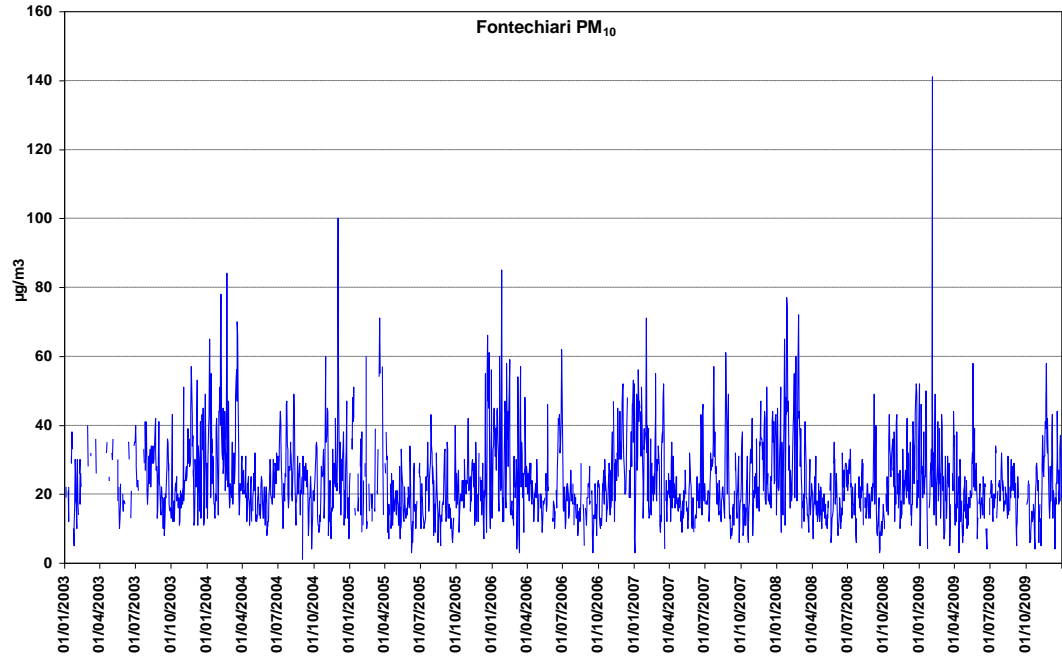
Moving average or moving 50th percentile?

[...] In absence of specific studies that identify the statistical indicator that better reproduce PM_{10} background concentration the use of a **more conservative indicator**, like the **average of the PM_{10} concentrations** registered during 15 days before and 15 days after the analyzed dust outbreak episode excluding the days with the identified episode, or the moving 50 percentile of 30 days, should be preferred [...]

GLs § 4.1.2

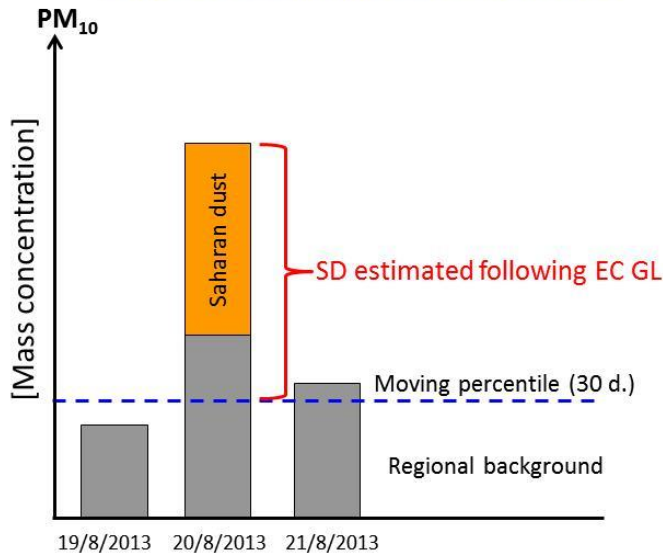


Possible overestimation of Saharan contribution to PM₁₀ following the EC GLs

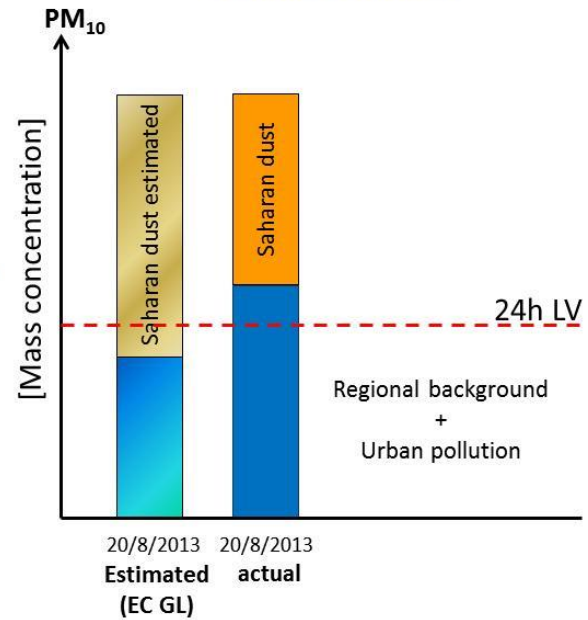


Fontechiari (Lazio)
R-B station

Regional Background station



Urban station



Subtraction of exceedances attributable to natural sources

ISPRA application of EC 2011 guideliens vs DIAPASON approach

Dust outbreak episodes (load>0)	ISPRA	DIAPASON
total identified events (load \neq 0)	5101	6026
Events with positive load (load > 0)	5025	4161
Events with negative load (load < 0)	76	1865
Contemporary events (load \neq 0)	2809	
Only ISPRA events (load \neq 0)	2230	
Only diapason events (load \neq 0)		3217
Contemporary quantified events (load > 0)	2328	
No events (load = 0)	50214	49174
No events (%)	91%	89%
Days without PM ₁₀ data	3611	3611
Not evaluated days	0	115
Total	58926	58926

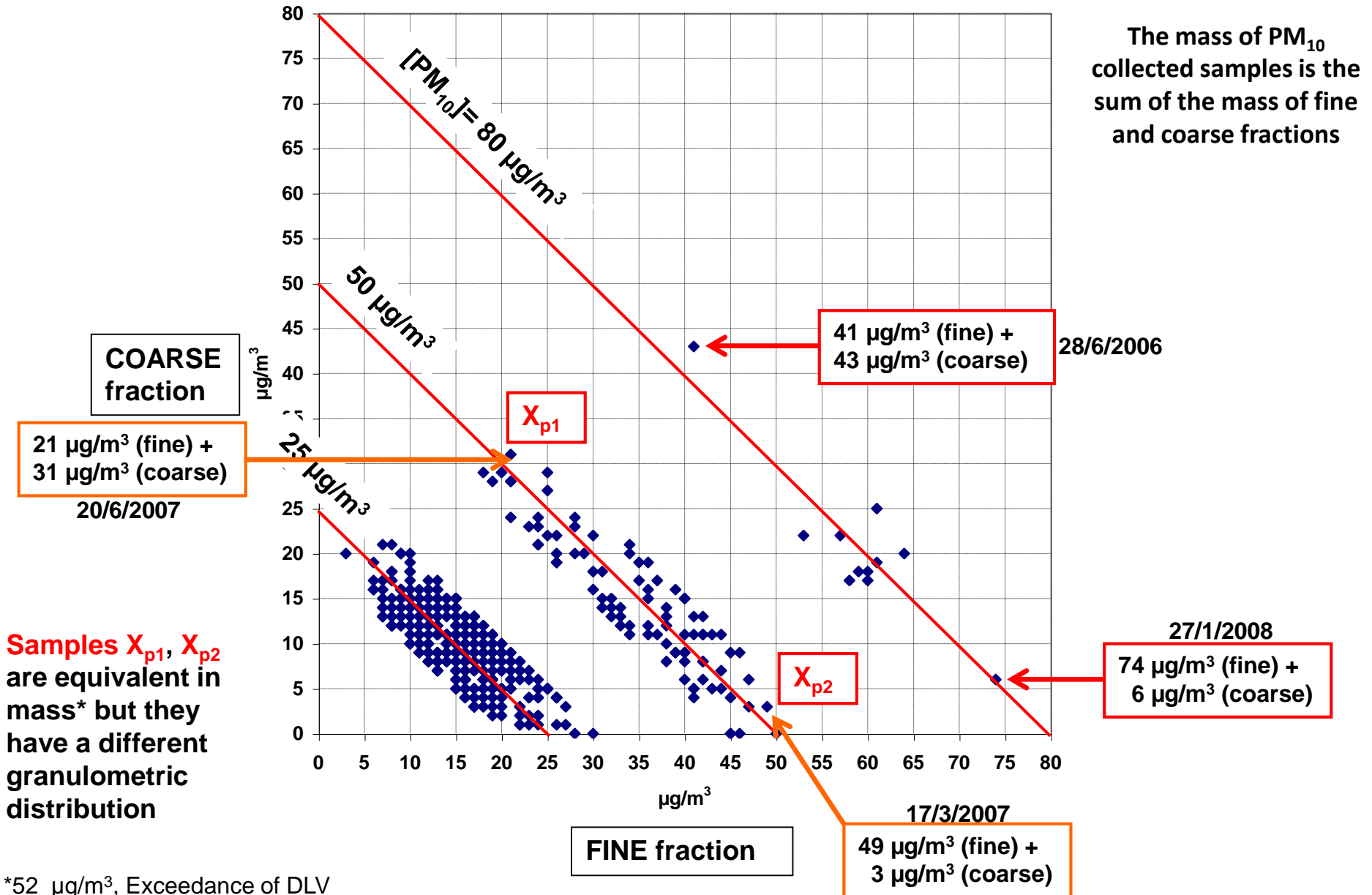
iD	Original exceedances	After sutraction of ISPRA exceedances	After sutraction of DIAPASON exceedances
1 402211	38	35	37
2 700904	36	34	35
3 803705	38	34	38
4 804009	36	34	34
5 1205875	45	35	44
6 1908485	37	35	27
7 1908966	36	16	12

2012 results
comparison

An alternative approach

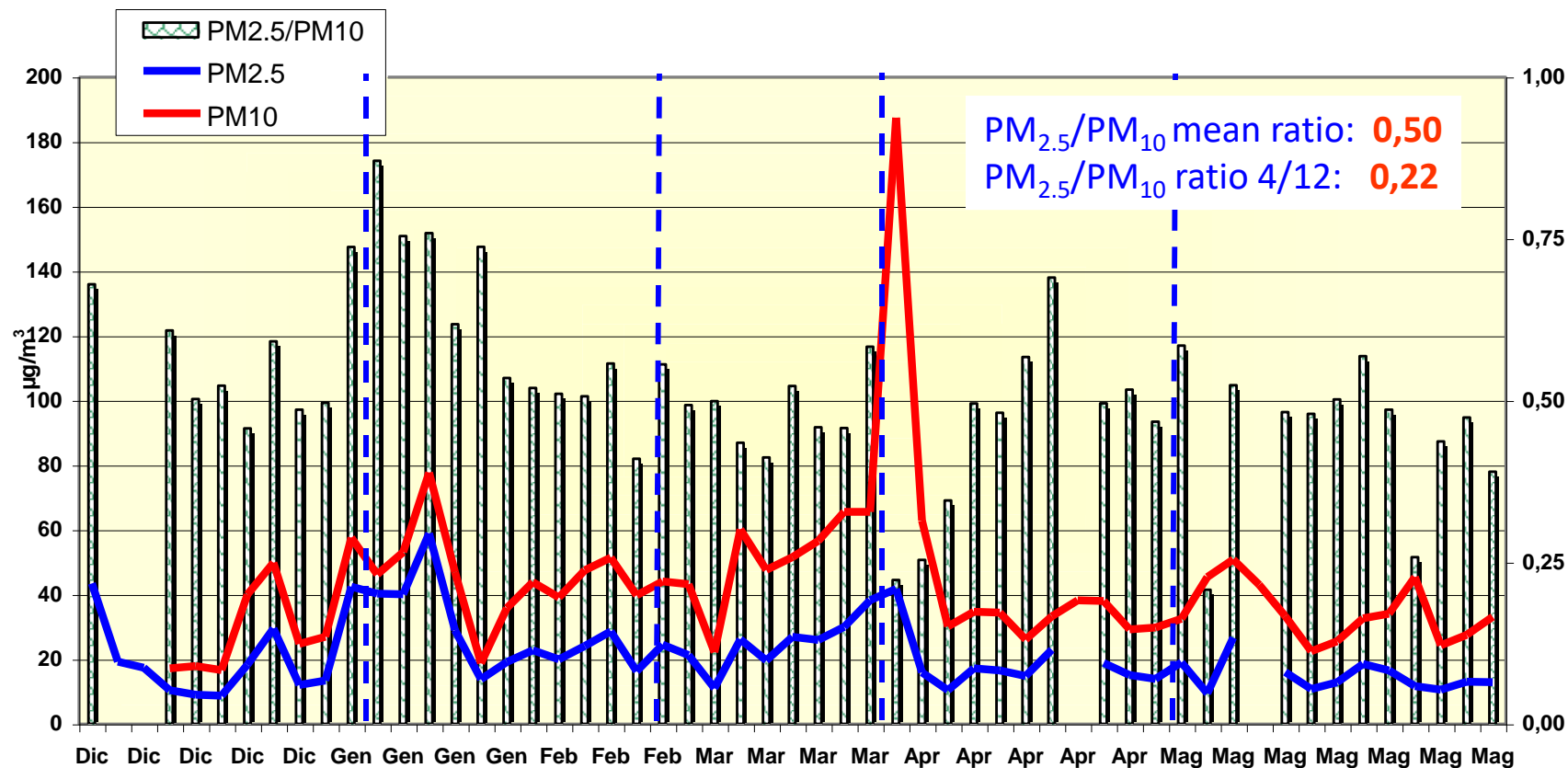
Equivalence between particulate matter samples

Rm - V. Ada coarse vs fine



Evaluation of $PM_{2.5}/PM_{10}$ mass concentration ratio

Saharan dust event - April 2002 *Montelibretti (Rome)*



APRIL 11



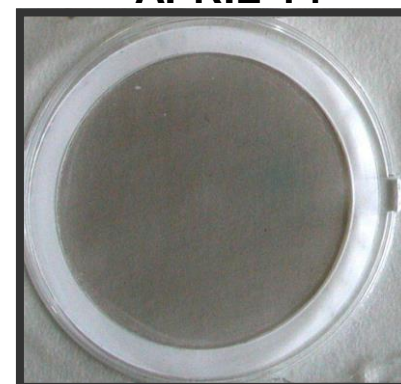
APRIL 12



APRIL 13



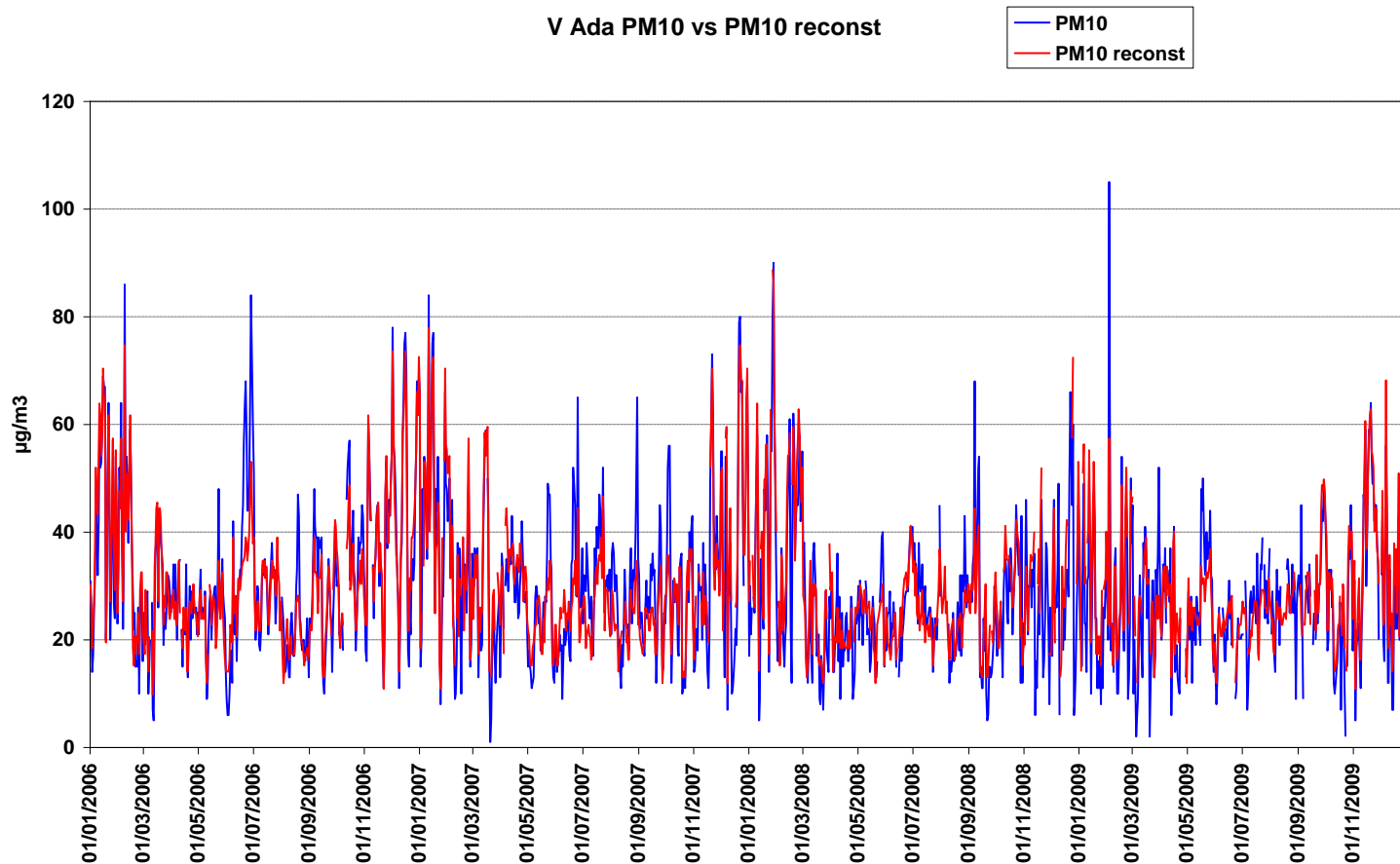
APRIL 14

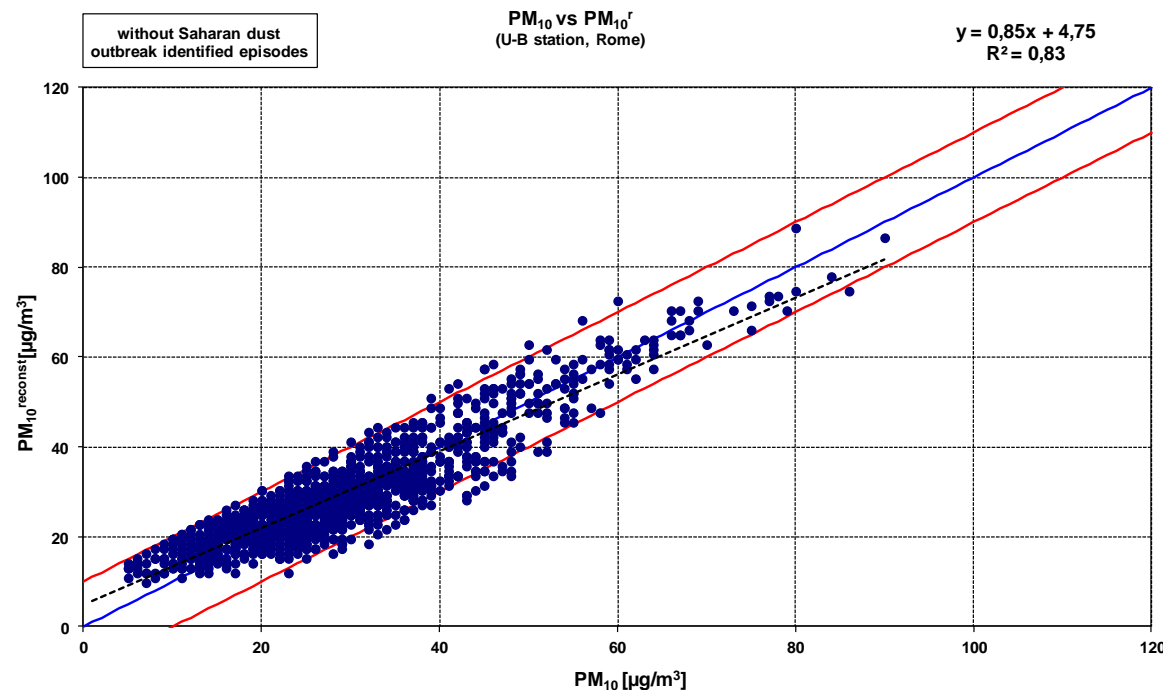
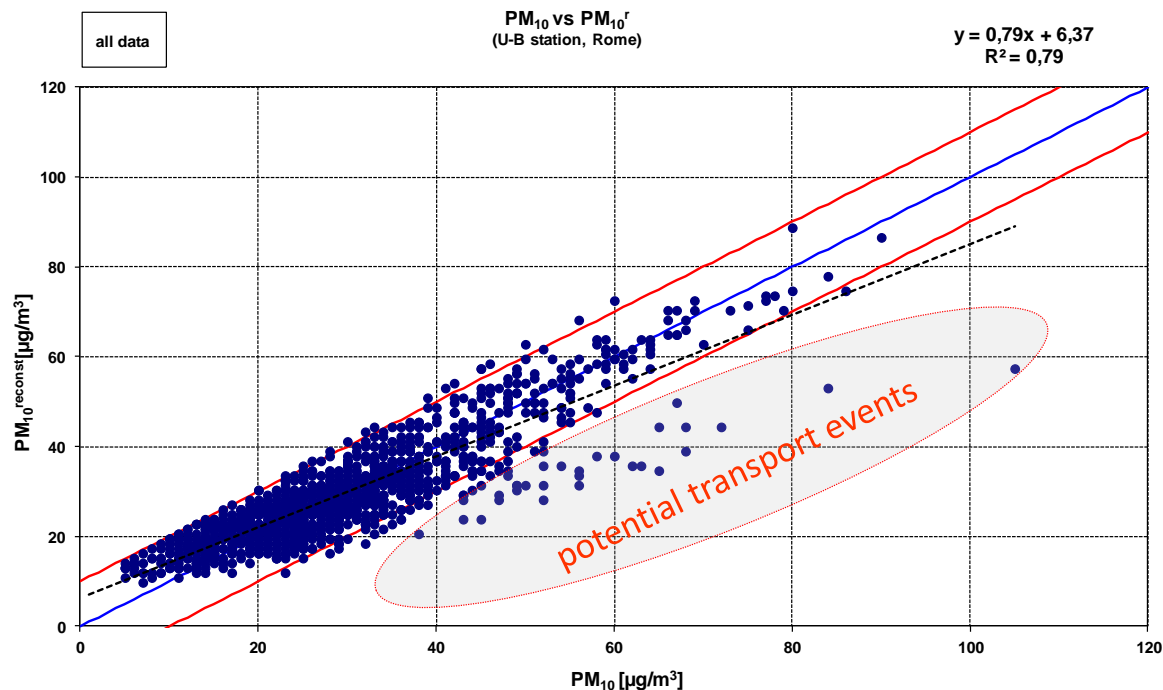


An alternative approach

Simple or multiple regression

- $[PM_{10}]_{w/o\ SD\ episodes} = a[PM_{2.5}] + b;$
- $[PM_{10}]_{w/o\ SD\ episodes} = a_1[PM_{2.5}] + a_2[NO] + a_3[NO_2] + a_4[CO] + a_5[C_6H_6] + a_6f(H_{PBL}) + b$





Potential transport events vs Dream forecast

V. Ada	PM10	PM10 ^r	Dream	Note
20/06/2006	56	35	Si	
21/06/2006	63	36	Si	
22/06/2006	68	39	Si	
23/06/2006	58	38	Si	
27/06/2006	67	50	Si	
28/06/2006	84	53	Si	
29/06/2006	72	44	Si	
30/06/2006	60	38	Si	
19/08/2006	47	28	Si	
23/05/2007	49	31	Si	
24/05/2007	47	29	Si	
20/06/2007	52	31	Si	
21/06/2007	49	30	Si	
25/06/2007	65	44	Si	
05/07/2007	38	21	No	
29/08/2007	49	31	-	no Dream data
30/08/2007	65	35	-	no Dream data
03/10/2007	52	36	Si	
04/10/2007	56	34	Si	
05/10/2007	56	31	Si	
07/09/2008	68	44	Si	
11/09/2008	52	41	Si	
12/09/2008	54	36	Si	
29/10/2008	43	24	Si	
03/02/2009	105	57	Si	
04/02/2009	62	36	Si	
30/03/2009	52	28	Si	
18/05/2009	50	31	Si	
04/09/2009	45	24	No	

Estimated dust concentration [µg/m³]

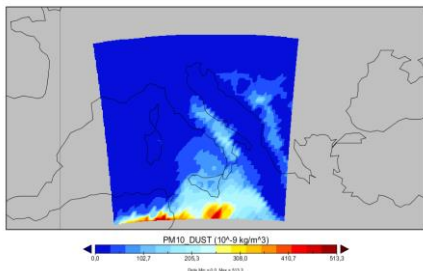
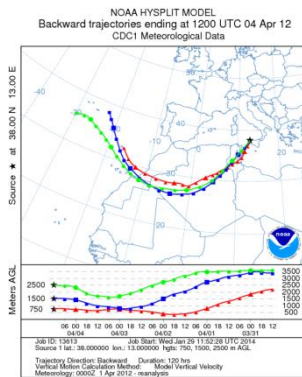
A	H	I	J	K	L
	V Ada	V Ada	V Ada	$y = 1,0819x + 3,7057$	Diff PM10-PM10 ^r
data	PM10	PM2.5	2.5M10	PM10 reconstr	
30/08/2008	32	19	0.59	29	-3
31/08/2008	27	20	0.74	30	-3
01/09/2008	29	16	0.55	26	3
02/09/2008	26	15	0.58	25	1
03/09/2008	30	20	0.67	30	0
04/09/2008	27	19	0.70	29	-2
05/09/2008	34	19	0.56	29	5
06/09/2008	36	23	0.64	34	2
07/09/2008	68	33	0.49	44	24
08/09/2008	33	15	0.45	25	8
09/09/2008	32	19	0.59	29	3
10/09/2008	43	27	0.63	38	5
11/09/2008	52	30	0.58	41	11
12/09/2008	54	25	0.46	36	18
13/09/2008	13	5	0.38	14	-1
14/09/2008	15	5	0.33	14	1
15/09/2008	11	4	0.36	13	-2
16/09/2008	11	6	0.55	15	-4
17/09/2008	24	10	0.42	20	4
18/09/2008	18	15	0.83	25	-7
19/09/2008	25	20	0.80	30	-5

ISPRA and ASI Framework agreement

Evaluation of the contribution of accidental and natural events to air pollution

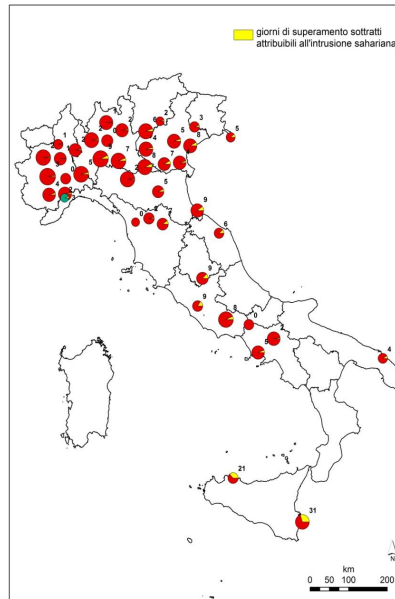
INPUT

- AQ monitoring networks data
- DB State Forestry Corp
- ISPRA emission estimates
- Dust Identification tools
- CAMS dust forecasts service



METHOD

Identification and estimate of the contribution to the concentration on the days of event



in collaboration with ARPA LAZIO and ARPA PIEMONTE

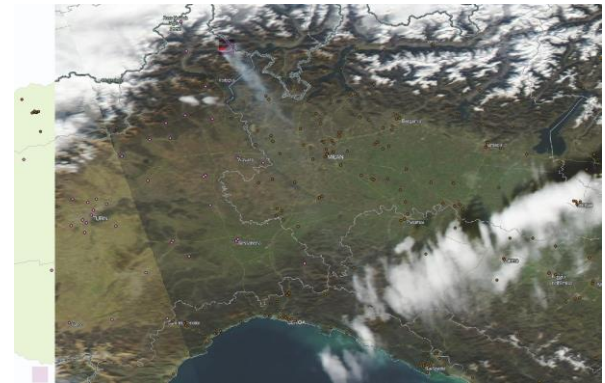
OUTPUT

Extension to accidental events (fires) of the quantification method (in prototype form)

Improved estimates with the use of Sentinel3 and Sentinel 5p data and CAMS products

Automation of the process of identifying natural events

Pre-operative reanalysis service



- At the present time, no satellite measurements have been used to quantitatively address **Air Quality standards**.
- Precision in measuring: i.e for AOD is $\pm 20\%$, and the relationship to $PM_{2.5}$ is at best $\pm 30\%$. This is not currently sufficient for regulatory use.

Recommendations for improving the reliability of European guidelines

Moderate change

- Define criteria that allowed a univocal selection of a reference station for a given area;
- automate processes of identification and quantification of natural contribution;
- overcome the possible option among different moving percentile values and average concentration.

Radical change

- Consider **Suburban** or, better, **Urban Background** stations instead of **Rural** to improve the spatial representativeness of the assessment;
- quantify Saharan contribution to PM_{10} concentration estimating PM_{10} data series in absence of external particle intrusions using AQ data available from local networks and PBL height freely downloadable from the Net (MACC or another).

Expected improvements

- Better reliability of identification and quantification of natural contribution;
- increase in the number of correctly subtracted exceedances.

**ISPRA working group for subtraction of
exceedances attributable to natural sources
under the Directive 2008/50/EC**

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Alessandro Di Menno di Bucchianico,
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